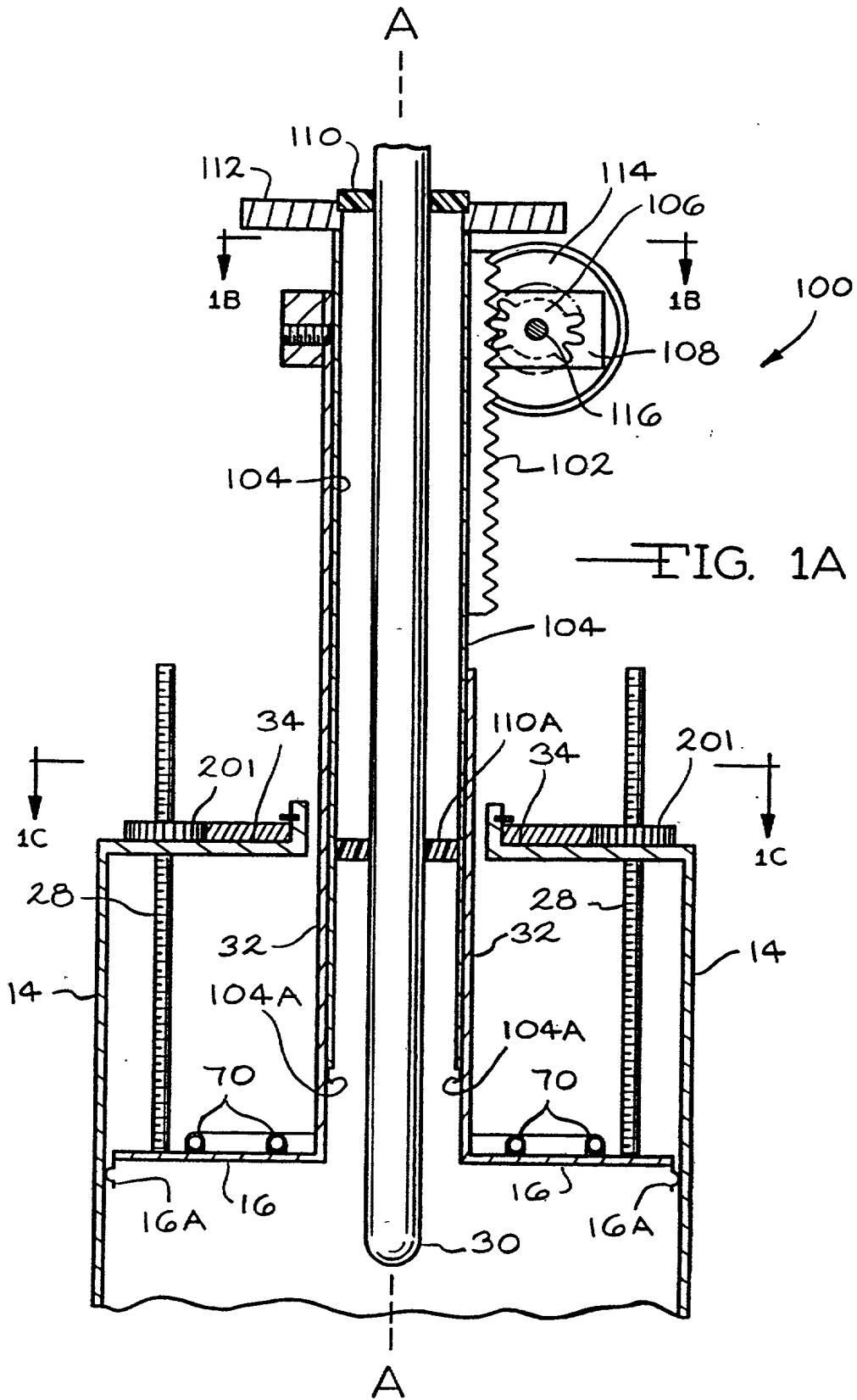


FIG. 1



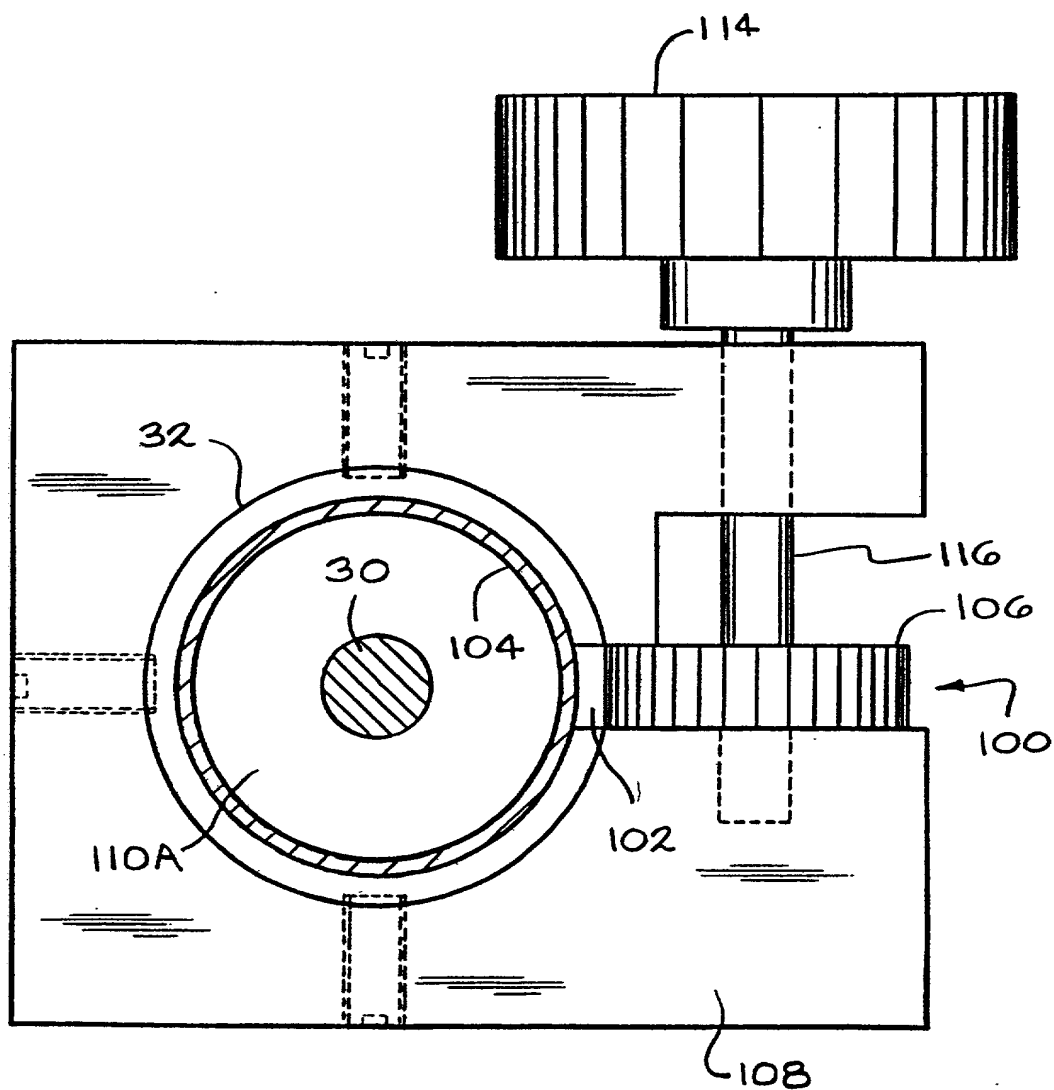
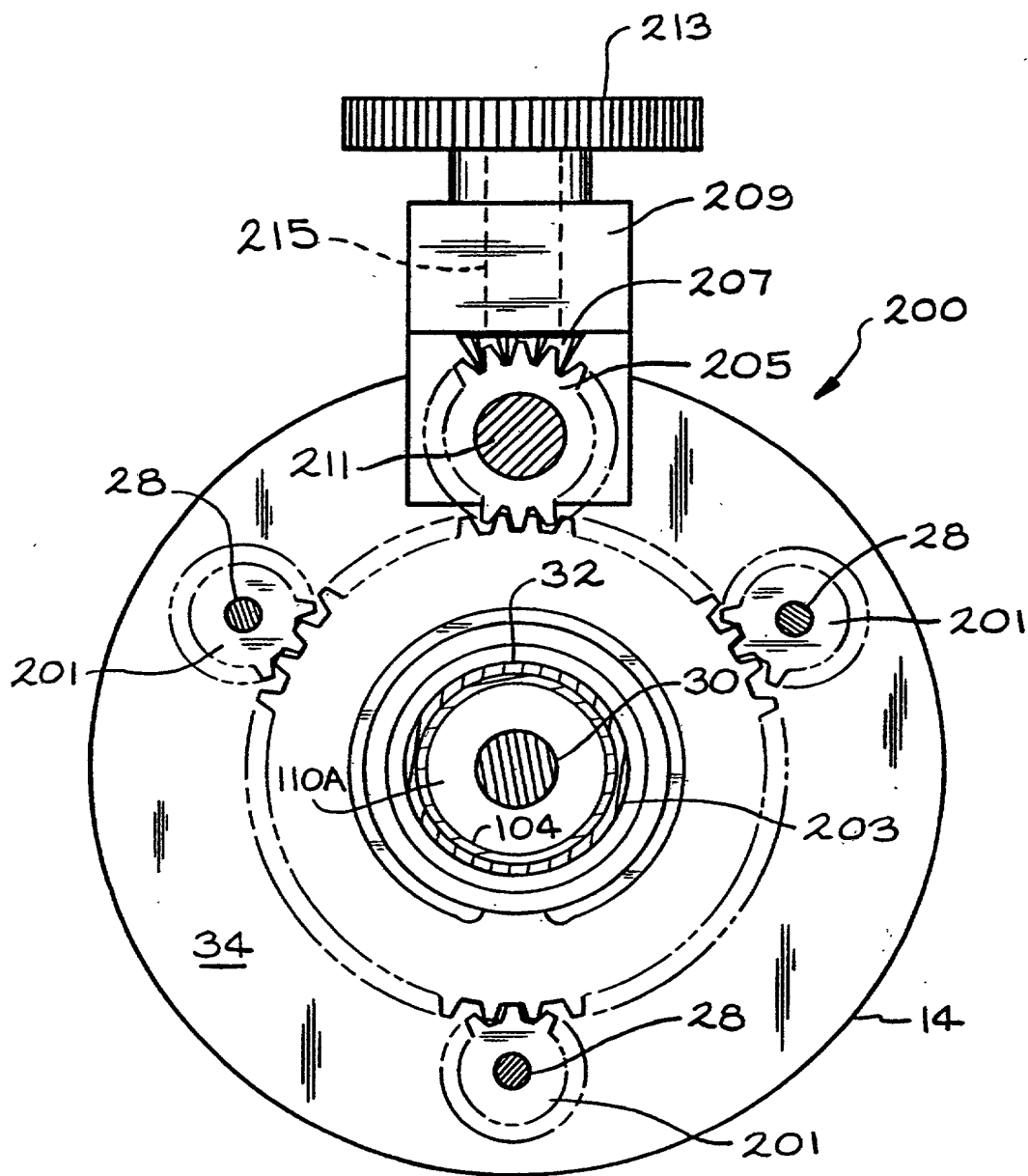


FIG. 1B



—FIG. 1C

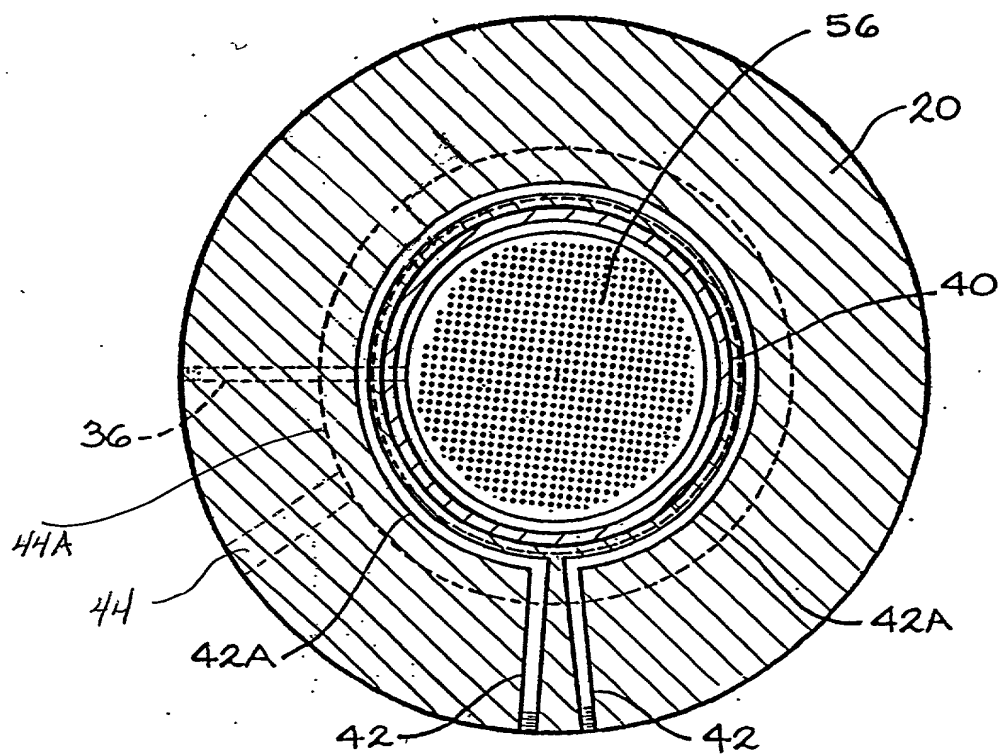


FIG. 1D

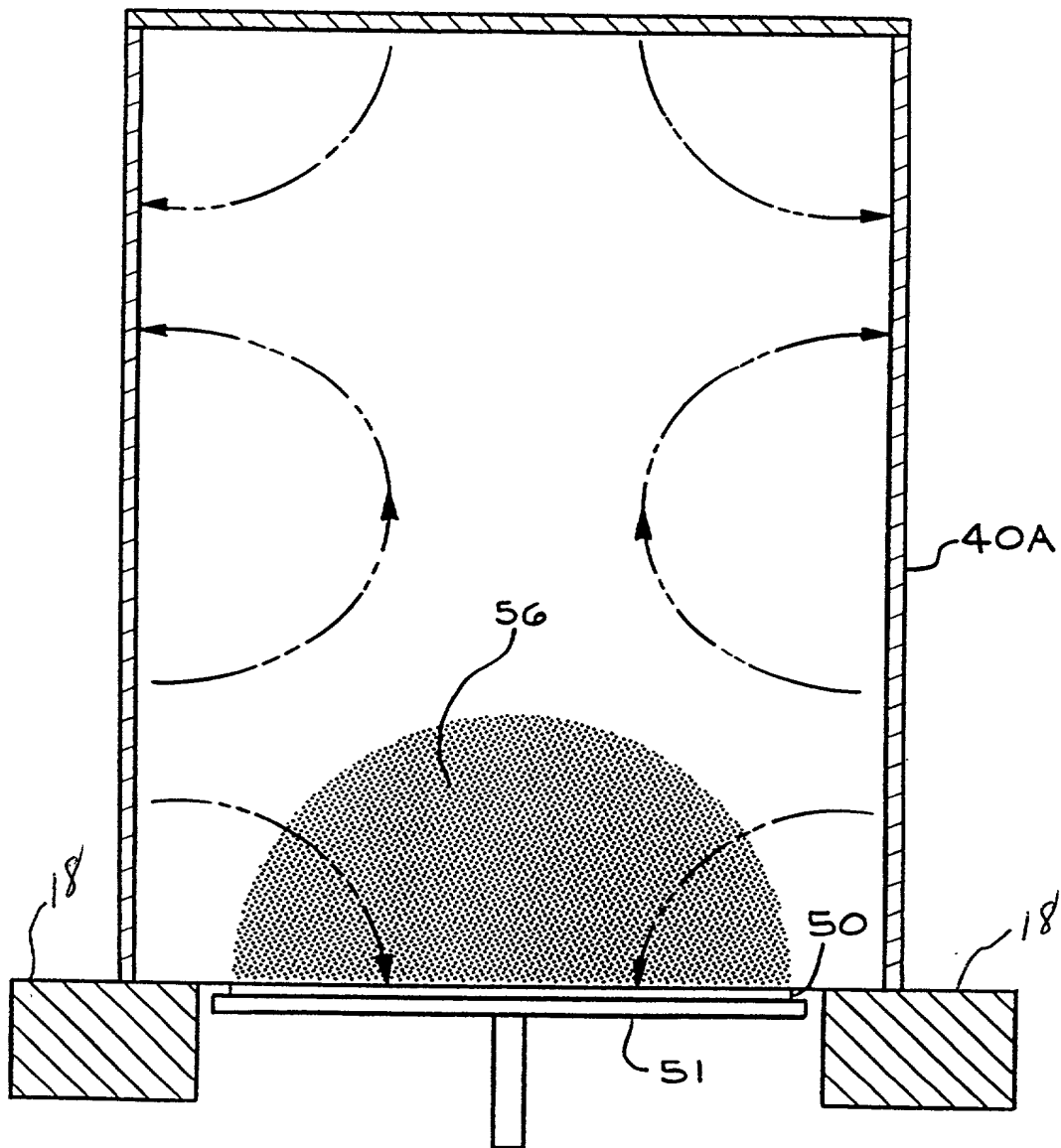


FIGURE 1E

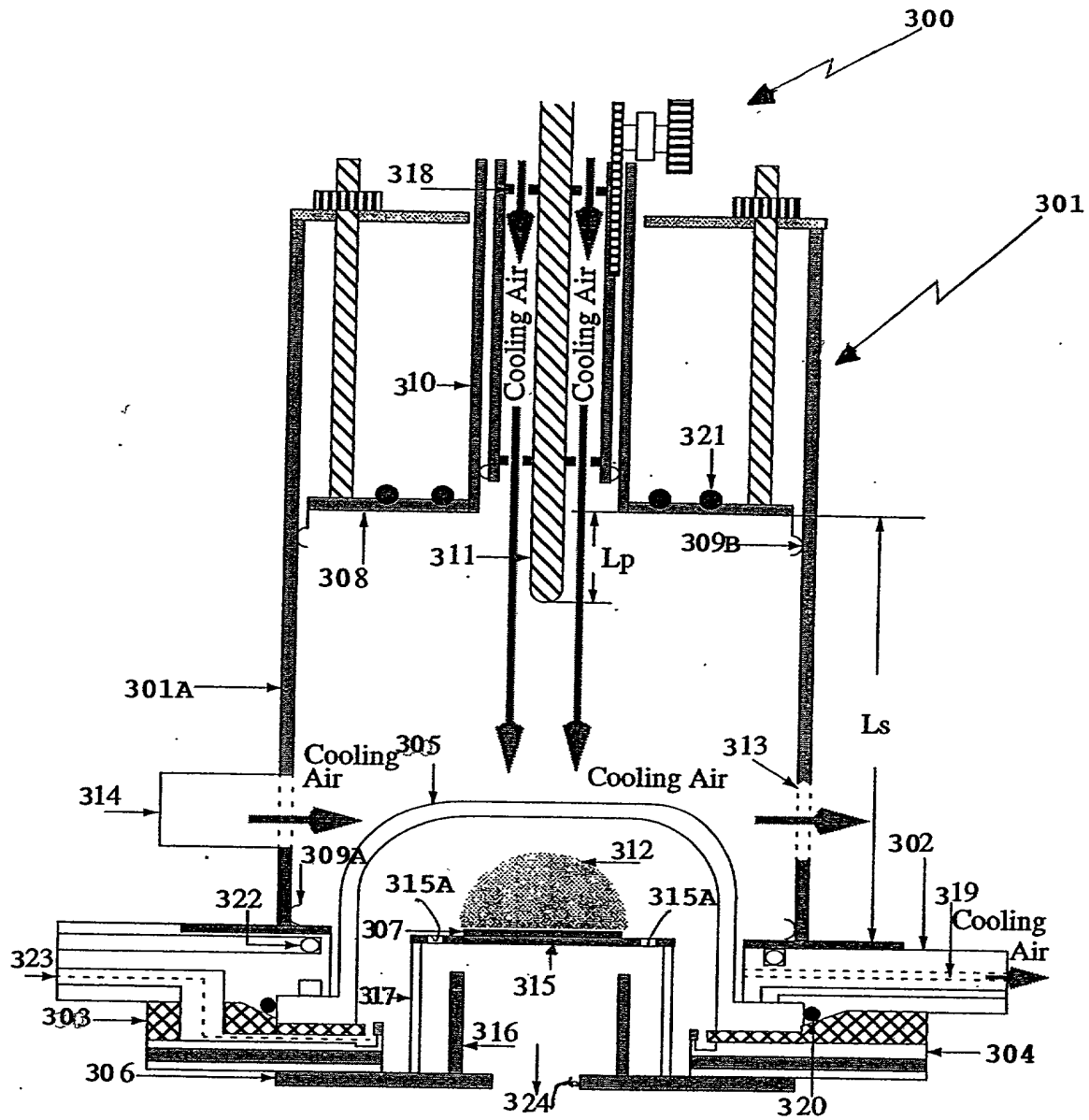


FIGURE 1F

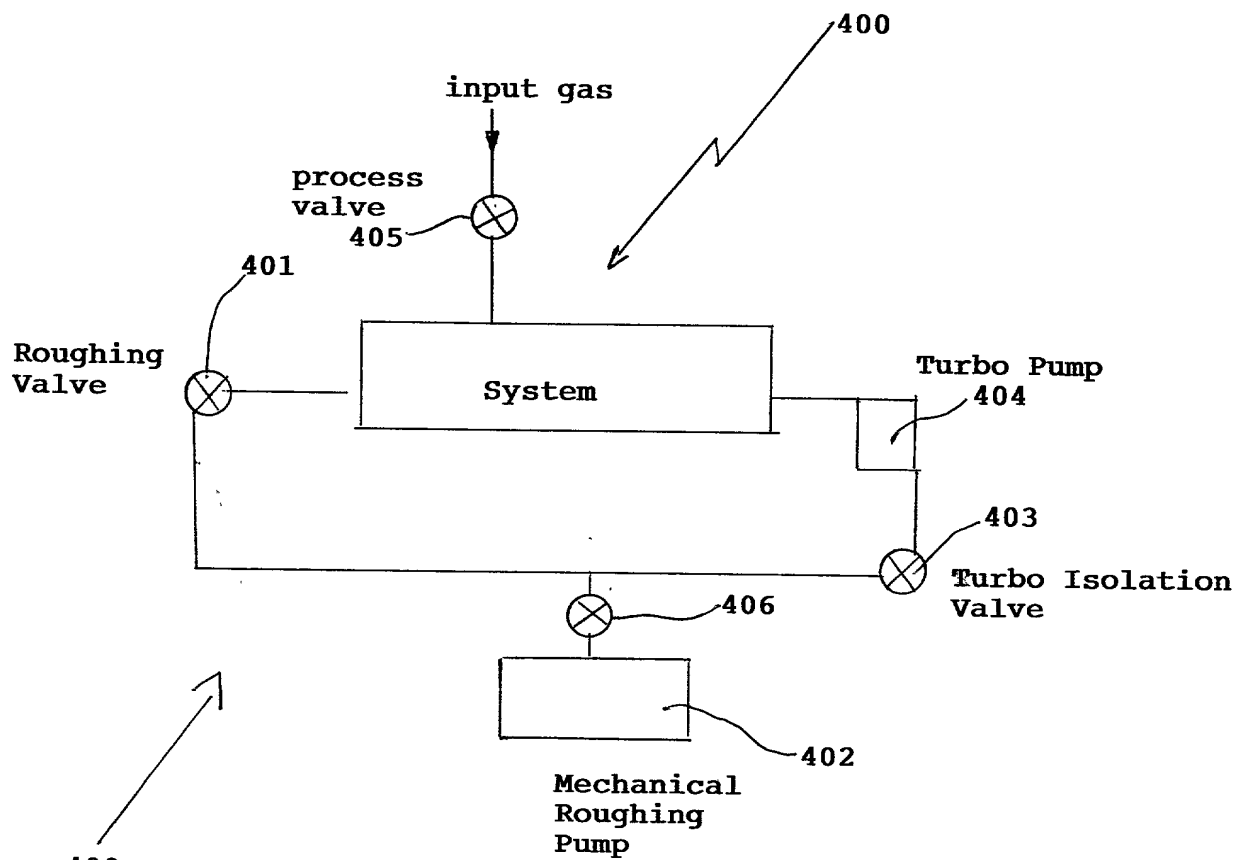


FIGURE 1G

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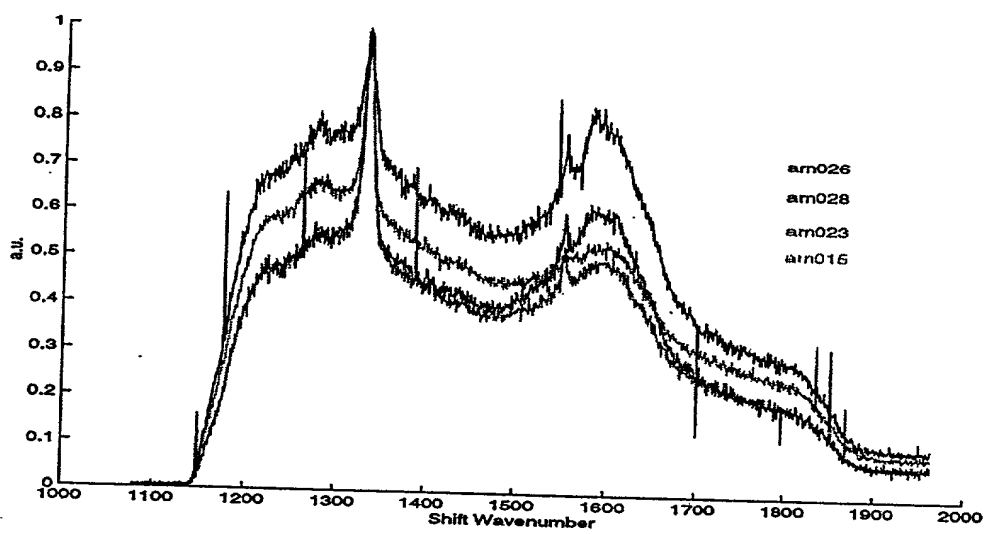


FIGURE 2

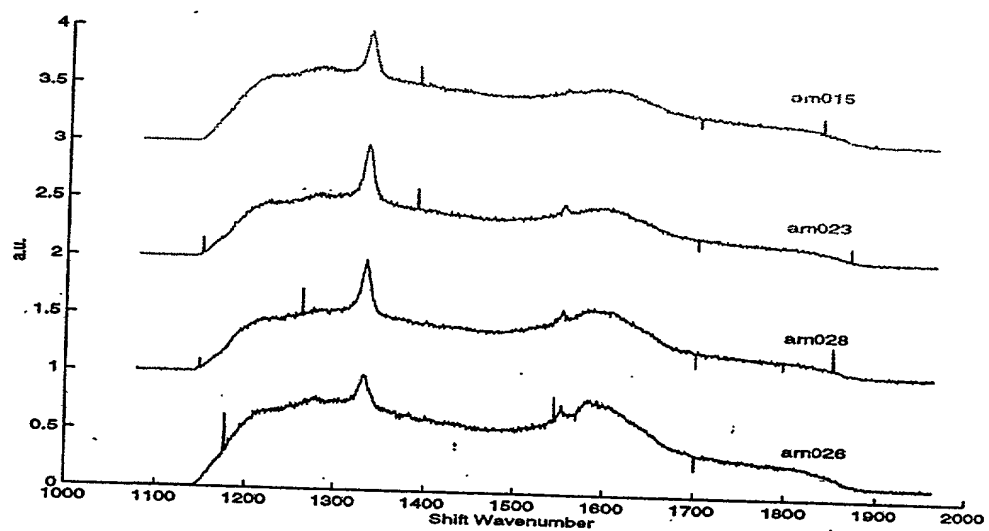


FIGURE 3

Pressure Investigation: Ar/H₂/CH₄=100/0/1 sccm

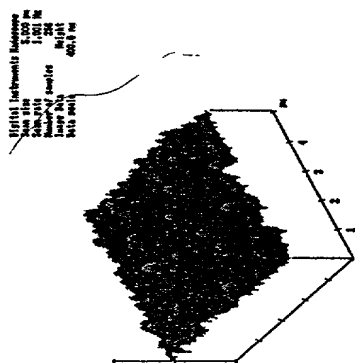


FIG. 4A

60 Torr, Img. RMS=33.322 nm,
growth=0.011 $\mu\text{m/hr}$

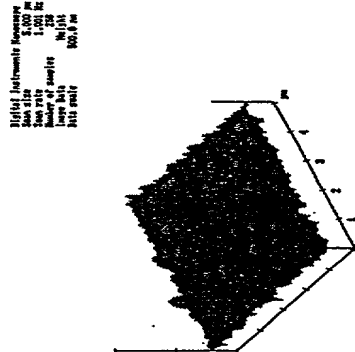


FIG. 4B

80 Torr, Img. RMS=22.696 nm,
growth=0.018 $\mu\text{m/hr}$

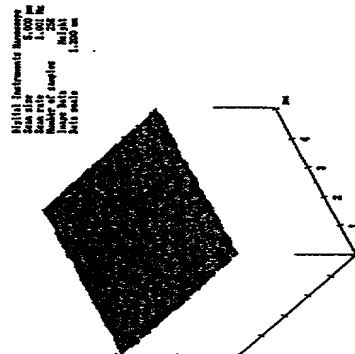


FIG. 4C

100 Torr, Img. RMS=19.151 nm,
growth=0.051 $\mu\text{m/hr}$

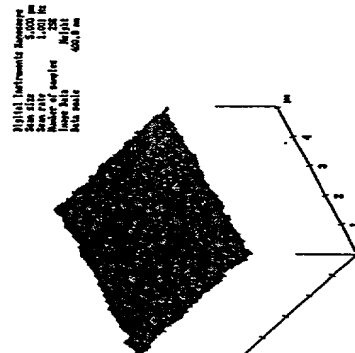


FIG. 4D

120 Torr, Img. RMS=10.859 nm,
growth=0.129 $\mu\text{m/hr}$

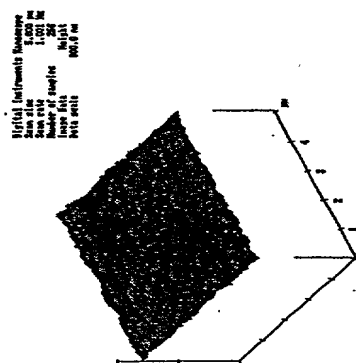


FIG. 4E

140 Torr, Img. RMS=13.584 nm,
growth=0.231 $\mu\text{m/hr}$

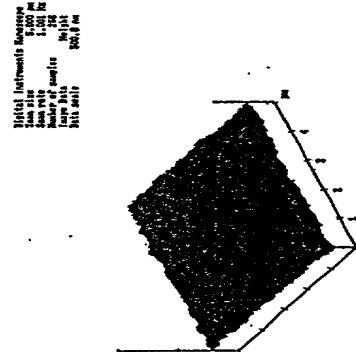


FIG. 4F

160 Torr, Img. RMS=13.462 nm,
growth=0.311 $\mu\text{m/hr}$

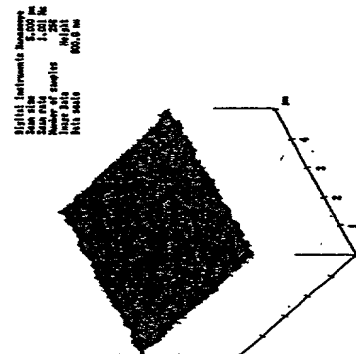


FIG. 4G

180 Torr, Img. RMS=16.782 nm,
growth=0.296 $\mu\text{m/hr}$

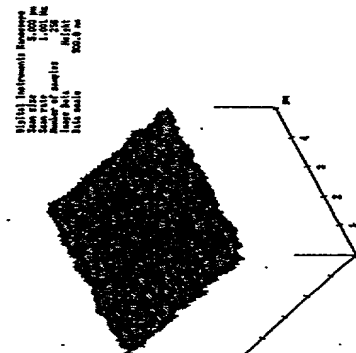


FIG. 4H

200 Torr, Img. RMS=18.371 nm,
growth=0.331 $\mu\text{m/hr}$

Pressure Investigation: Ar/H₂/CH₄=100/4/1 sccm

Initial Instrument Response
Scan size 1,000 nm
Scan rate 1,000 nm/s
Number of samples 256
Lower bits 256
Data width 256.0 nm

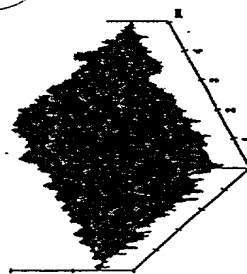


FIG. 5A 1,000 nm/div
60 Torr, Img. RMS=40.538 nm,
growth=0.014 $\mu\text{m/hr}$

Initial Instrument Response
Scan size 1,000 nm
Scan rate 1,000 nm/s
Number of samples 256
Lower bits 256
Data width 256.0 nm

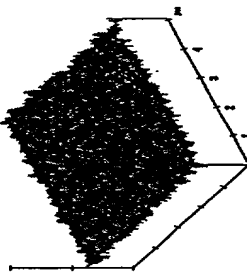


FIG. 5B 1,000 nm/div
80 Torr, Img. RMS=16.363 nm,
growth=0.055 $\mu\text{m/hr}$

Initial Instrument Response
Scan size 1,000 nm
Scan rate 1,000 nm/s
Number of samples 256
Lower bits 256
Data width 256.0 nm

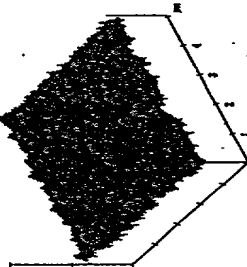


FIG. 5C 1,000 nm/div
100 Torr, Img. RMS=19.250 nm,
growth=0.118 $\mu\text{m/hr}$

Initial Instrument Response
Scan size 1,000 nm
Scan rate 1,000 nm/s
Number of samples 256
Lower bits 256
Data width 256.0 nm

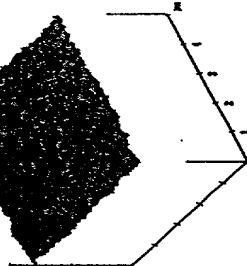


FIG. 5D 1,000 nm/div
120 Torr, Img. RMS=24.332 nm,
growth=0.237 $\mu\text{m/hr}$

Initial Instrument Response
Scan size 1,000 nm
Scan rate 1,000 nm/s
Number of samples 256
Lower bits 256
Data width 256.0 nm

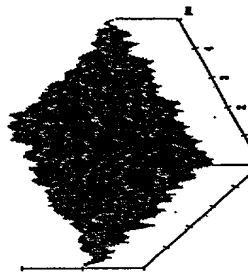


FIG. 5E 1,000 nm/div
140 Torr, Img. RMS=24.942 nm,
growth=0.400 $\mu\text{m/hr}$

Initial Instrument Response
Scan size 1,000 nm
Scan rate 1,000 nm/s
Number of samples 256
Lower bits 256
Data width 256.0 nm

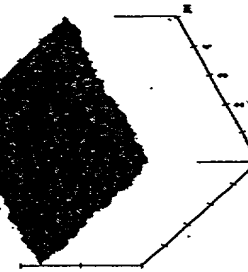


FIG. 5F 1,000 nm/div
160 Torr, Img. RMS=31.763 nm,
growth=0.494 $\mu\text{m/hr}$

Initial Instrument Response
Scan size 1,000 nm
Scan rate 1,000 nm/s
Number of samples 256
Lower bits 256
Data width 256.0 nm

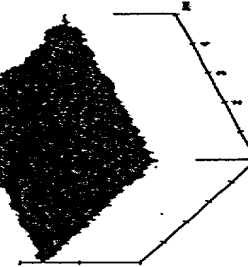


FIG. 5G 1,000 nm/div
180 Torr, Img. RMS=33.015 nm,
growth=0.614 $\mu\text{m/hr}$

Initial Instrument Response
Scan size 1,000 nm
Scan rate 1,000 nm/s
Number of samples 256
Lower bits 256
Data width 256.0 nm

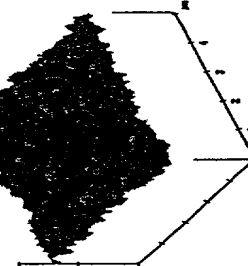


FIG. 5H 1,000 nm/div
200 Torr, Img. RMS=31.661 nm,
growth=0.792 $\mu\text{m/hr}$

H₂ Concentration Variation: P=120Torr

Digital Instruments Nanoscope
Scan size 1,000 nm
Scan rate 1,000 Hz
Number of samples 1024
Image size 1024 x 1024
Data size 400.0 nm

Digital Instruments Nanoscope
Scan size 1,000 nm
Scan rate 1,000 Hz
Number of samples 1024
Image size 1024 x 1024
Data size 400.0 nm

Digital Instruments Nanoscope
Scan size 1,000 nm
Scan rate 1,000 Hz
Number of samples 1024
Image size 1024 x 1024
Data size 400.0 nm

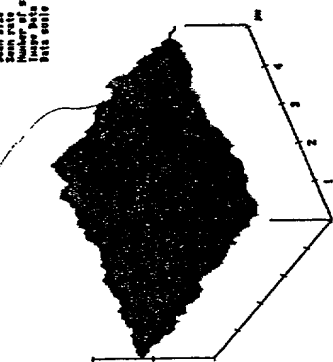


FIG. 6A

Ar/H₂/CH₄=100/10/1, Img. RMS=40.961 nm,
growth=0.337 μm/hr

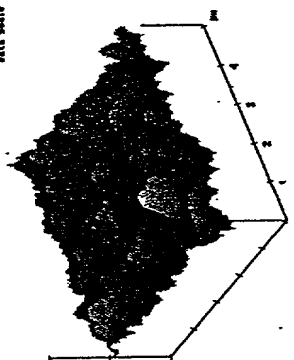


FIG. 6B

Ar/H₂/CH₄=100/8/1, Img. RMS=31.818 nm,
growth=0.328 μm/hr

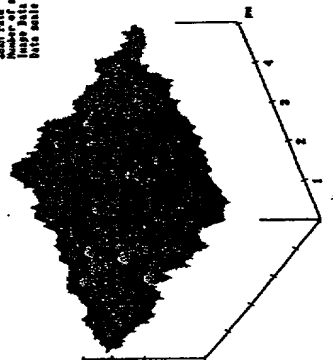


FIG. 6C

Ar/H₂/CH₄=100/6/1, Img. RMS=30.316 nm,
growth=0.283 μm/hr

Digital Instruments Nanoscope
Scan size 1,000 nm
Scan rate 1,000 Hz
Number of samples 1024
Image size 1024 x 1024
Data size 400.0 nm

Digital Instruments Nanoscope
Scan size 1,000 nm
Scan rate 1,000 Hz
Number of samples 1024
Image size 1024 x 1024
Data size 400.0 nm

Digital Instruments Nanoscope
Scan size 1,000 nm
Scan rate 1,000 Hz
Number of samples 1024
Image size 1024 x 1024
Data size 400.0 nm

Digital Instruments Nanoscope
Scan size 1,000 nm
Scan rate 1,000 Hz
Number of samples 1024
Image size 1024 x 1024
Data size 400.0 nm

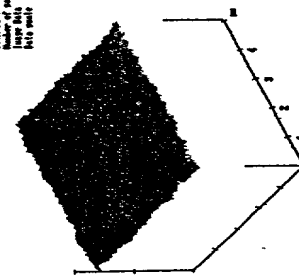


FIG. 6D

Ar/H₂/CH₄=100/4/1,
Img. RMS=24.332 nm,
growth=0.237 μm/hr

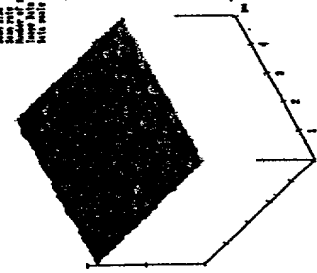


FIG. 6E

Ar/H₂/CH₄=100/2/1,
Img. RMS=16.208 nm,
growth=0.172 μm/hr

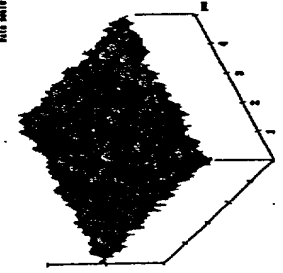


FIG. 6F

Ar/H₂/CH₄=100/1/1,
Img. RMS=12.787 nm,
growth=0.148 μm/hr

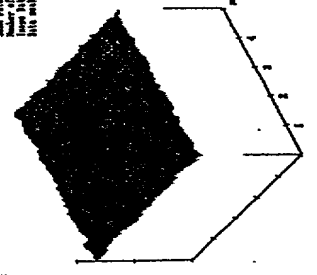


FIG. 6G

Ar/H₂/CH₄=100/0/1,
Img. RMS=10.859 nm,
growth=0.129 μm/hr

N₂ Impurity Study: P=120Torr, Ar/H₂/CH₄=100/4/1 sccm

Digital Instruments Nanoscope
Scan size 5.000 μ m
Scan rate 1.001 Hz
Number of samples 328
Image data Height 400.0 nm
Data scale 400.0 nm

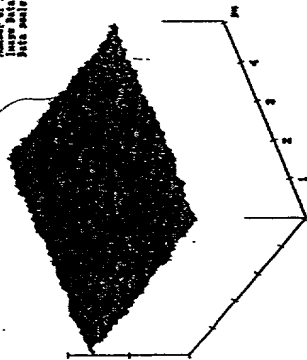


FIG. 7A

5ppm N, Img. RMS=24.332 nm,
growth=0.237 μ m/hr

am001.000

Digital Instruments Nanoscope
Scan size 5.000 μ m
Scan rate 1.001 Hz
Number of samples 328
Image data Height 400.0 nm
Data scale 400.0 nm

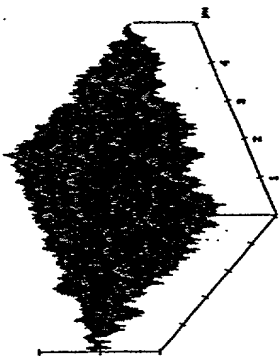


FIG. 7B

300ppm N, Img. RMS=20.447 nm,
growth=0.211 μ m/hr

am014.001

Digital Instruments Nanoscope
Scan size 5.000 μ m
Scan rate 1.001 Hz
Number of samples 328
Image data Height 400.0 nm
Data scale 400.0 nm

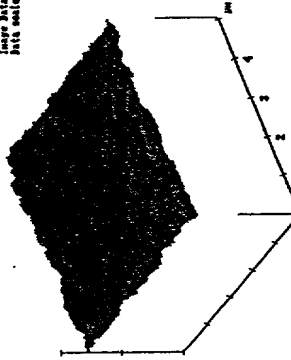


FIG. 7D

1500ppm N, Img. RMS=23.323 nm,
growth=0.164 μ m/hr

am019.000

Digital Instruments Nanoscope
Scan size 5.000 μ m
Scan rate 1.001 Hz
Number of samples 328
Image data Height 400.0 nm
Data scale 400.0 nm

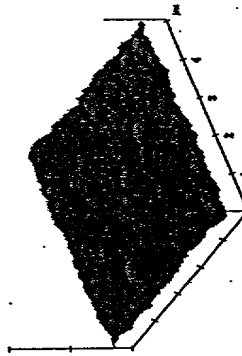


FIG. 7E

2000ppm N, Img. RMS=20.825 nm,
growth=0.160 μ m/hr

am041.000

Digital Instruments Nanoscope
Scan size 5.000 μ m
Scan rate 1.001 Hz
Number of samples 328
Image data Height 400.0 nm
Data scale 400.0 nm

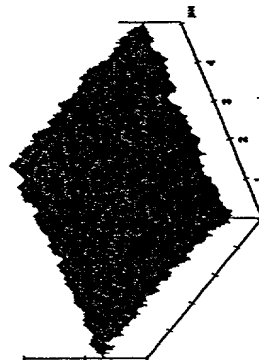


FIG. 7F

2500ppm N, Img. RMS=17.706 nm,
growth=0.147 μ m/hr

am022.000

FIG. 7C

800ppm N, Img. RMS=20.808 nm,
growth=0.187 μ m/hr

am017.000

$\text{Ar}/\text{H}_2/\text{CH}_4 = 100/0/1 \text{ sccm}$

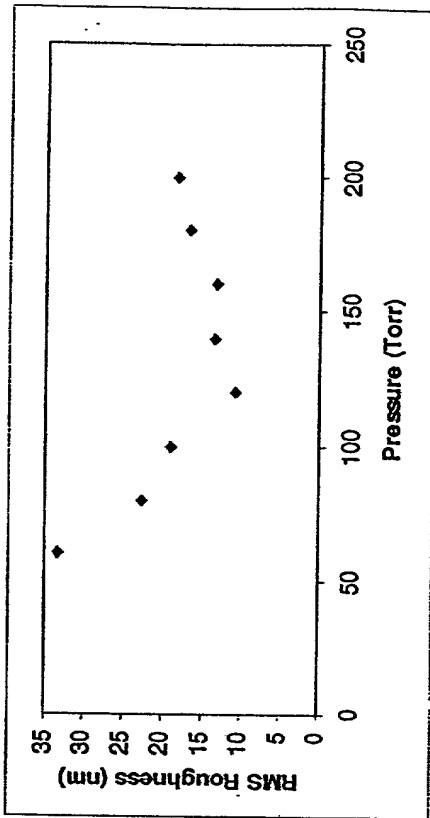
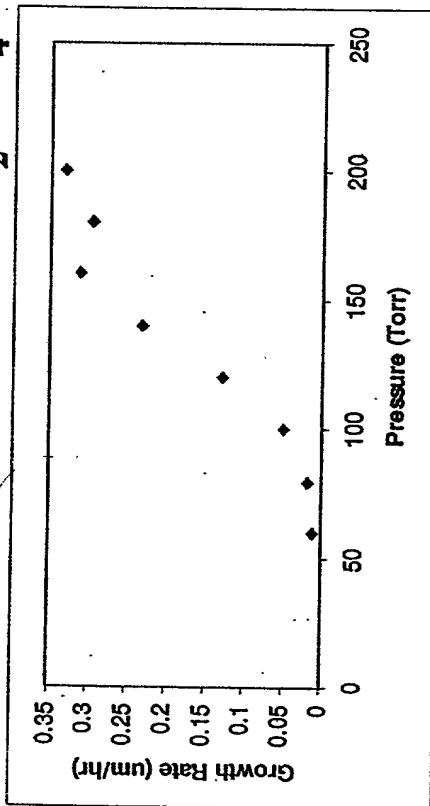


FIGURE 8

FIGURE 8A

$\text{Ar}/\text{H}_2/\text{CH}_4 = 100/4/1 \text{ sccm}$

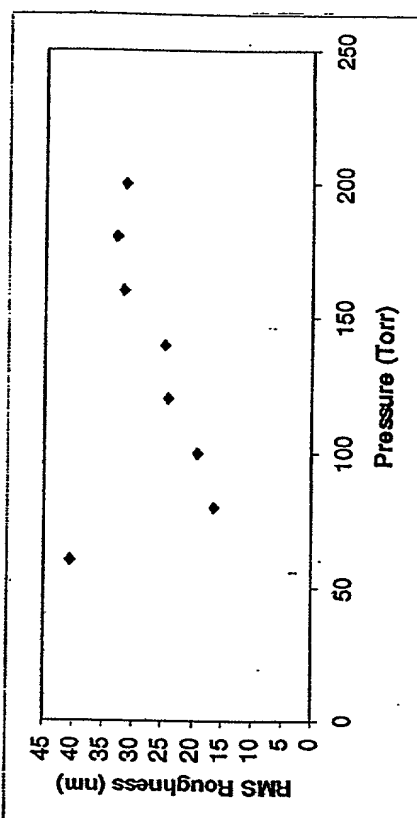
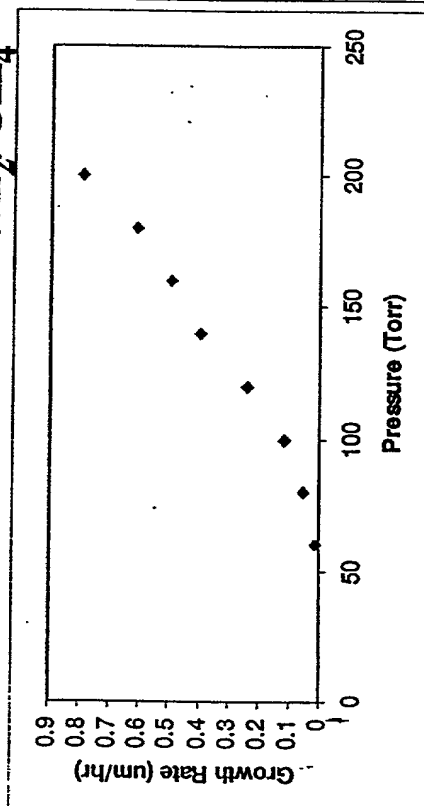


FIGURE 9

FIGURE 9A

H₂ Concentration: 120 Torr

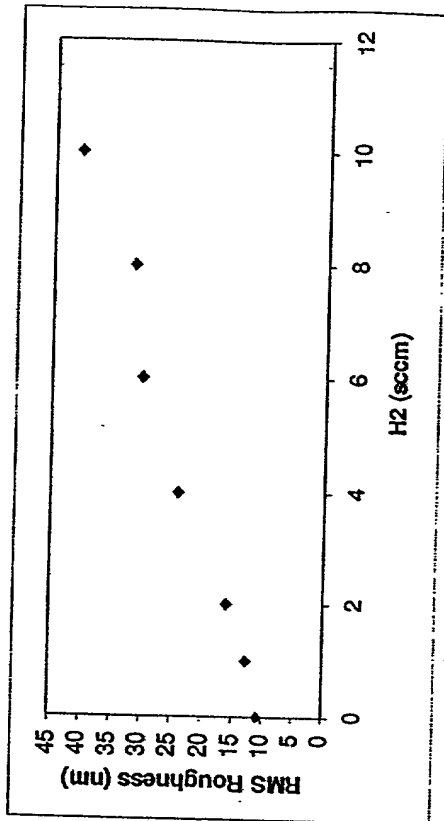
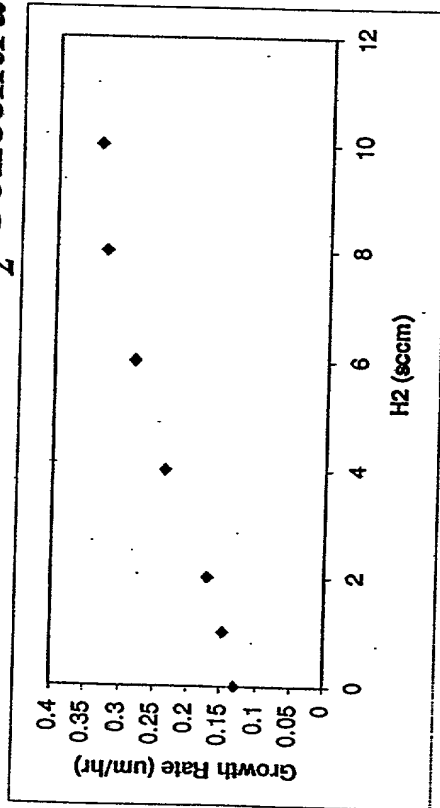


FIGURE 10

N₂ Impurity: P = 120 Torr, Ar/H₂/CH₄ = 100/4/1 sccm

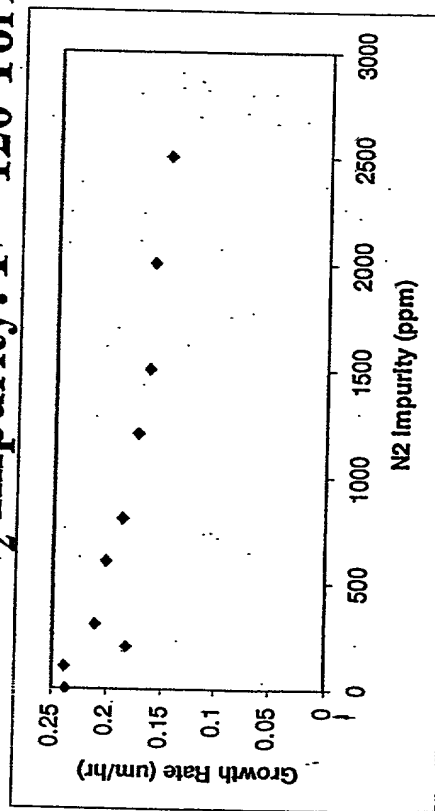


FIGURE 11

FIGURE 10A

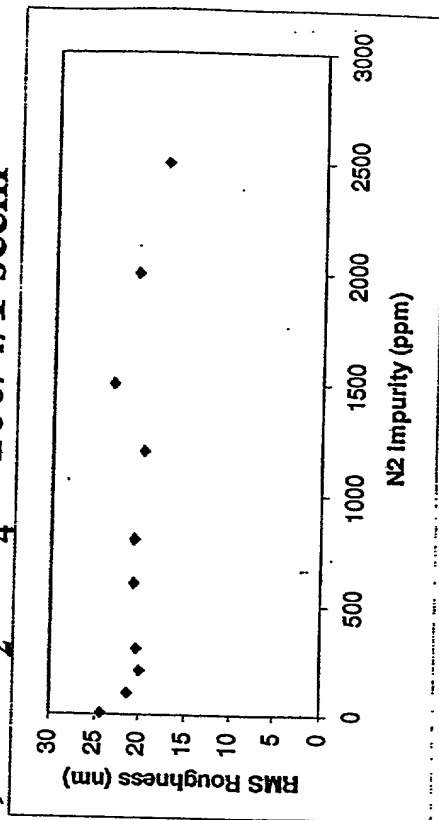
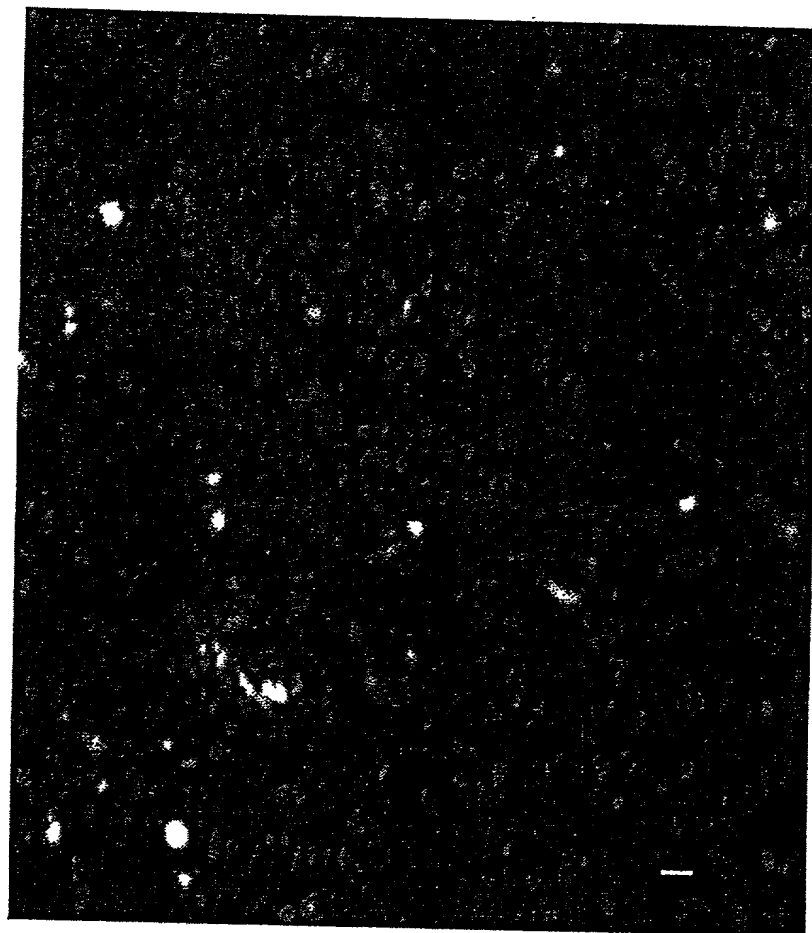


FIGURE 11A

201120 072E200T



— 10 nm

FIGURE 12

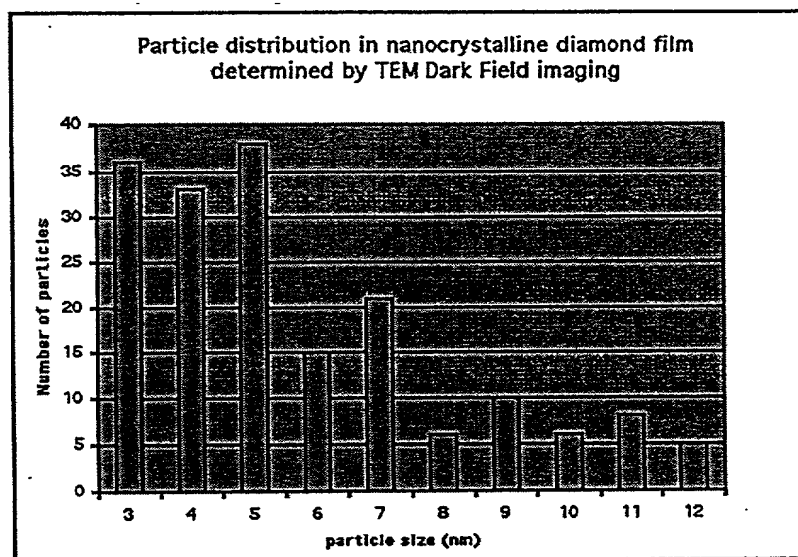


FIGURE 13

20170707 07:46:00

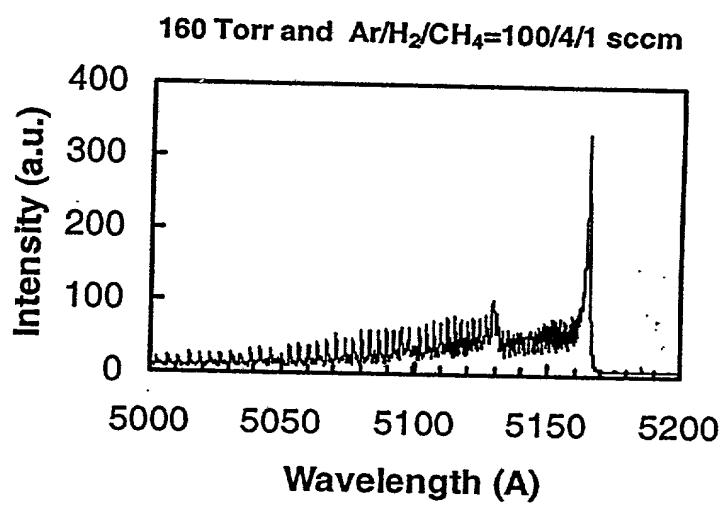


FIGURE 14

C₂ Rotational Temperature

Gas temperature versus pressure.

Gas temperature versus H₂ Flow.

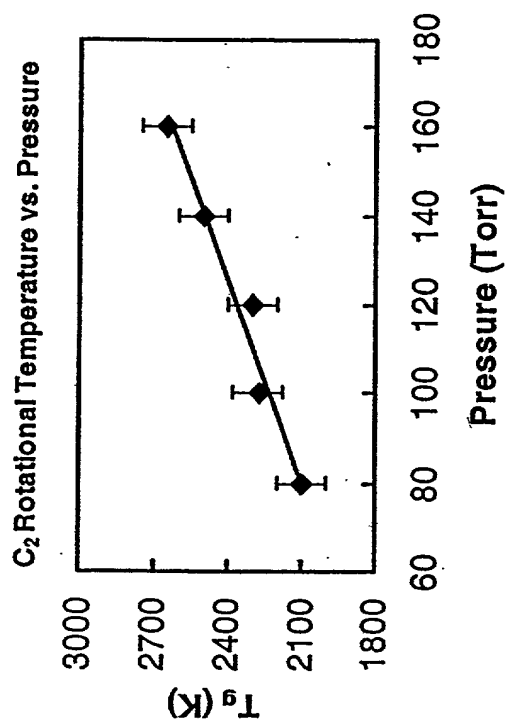


FIGURE 15

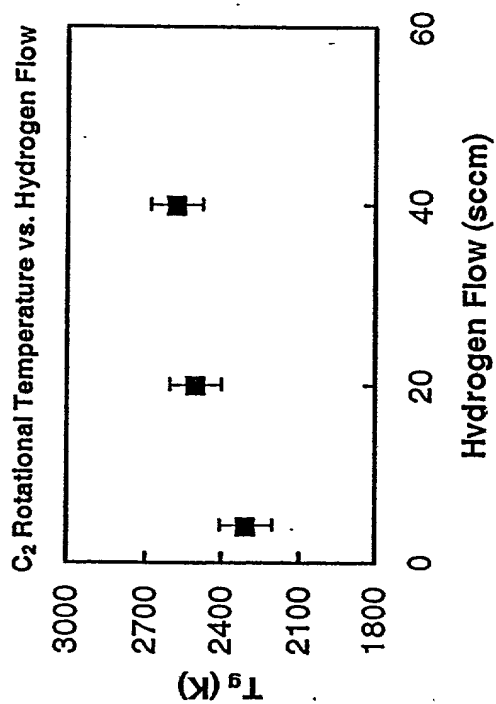


FIGURE 16

201720 01/E/001

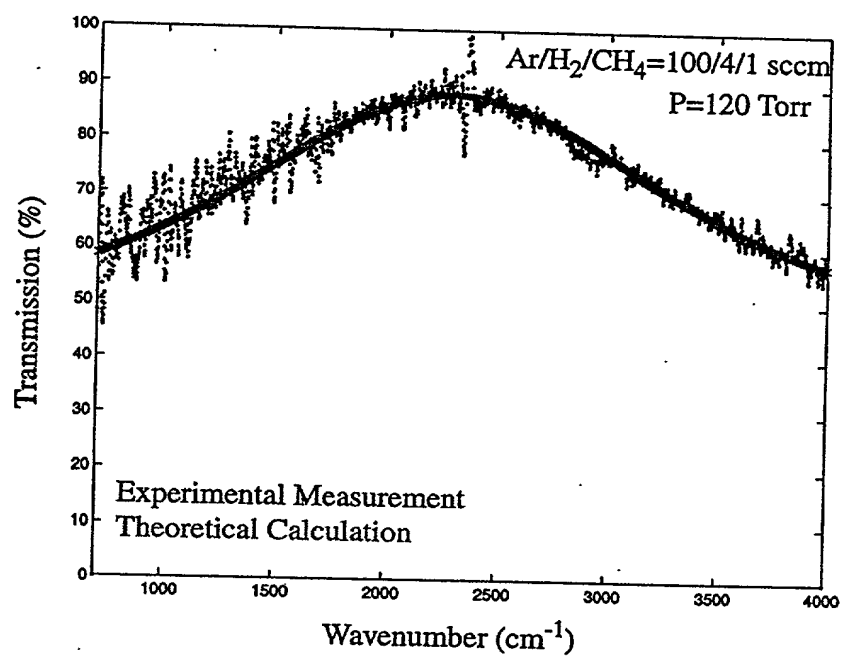


FIGURE 17

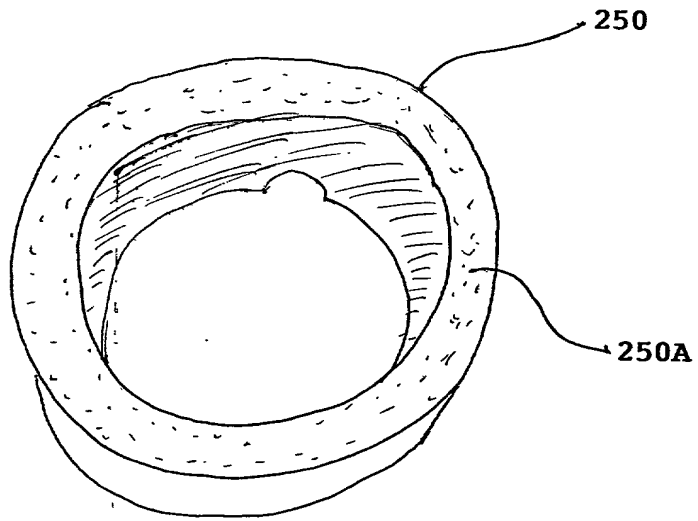


FIGURE 18

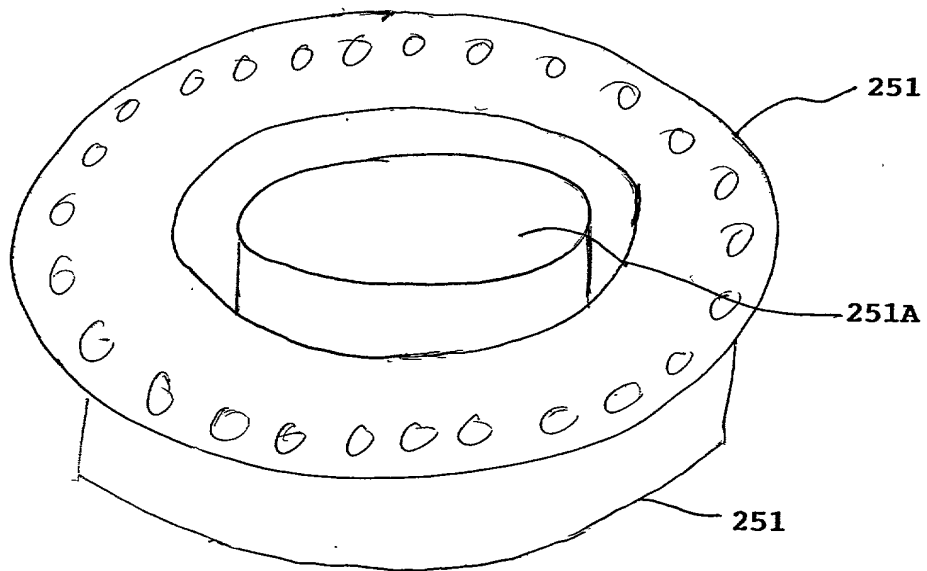


FIGURE 19

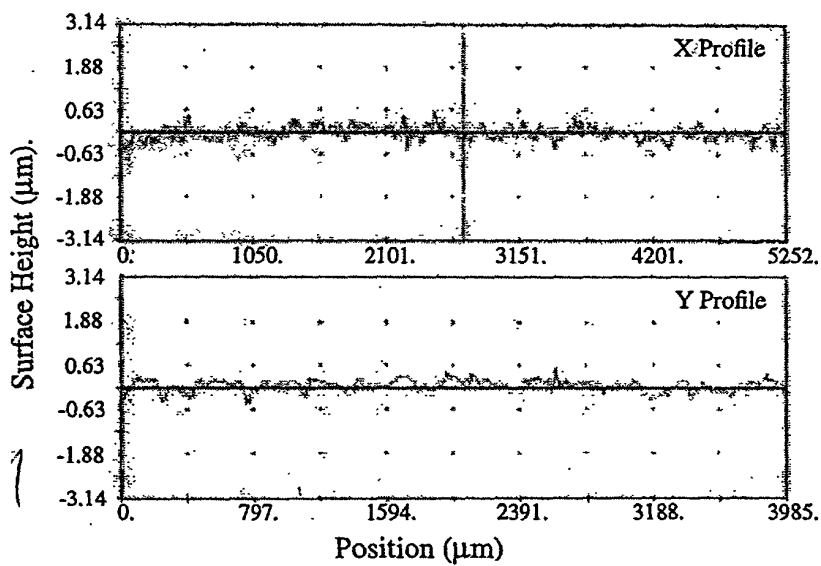


FIG. 20

FIG. 20A